Voluntary Product Standard

PS 73-77

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

CARBONATED SOFT DRINK BOTTLES

AMERICAN NATIONAL STANDARD

ANSI/VPS PS 73-77

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Voluntary Product Standard PS 73–77

Carbonated Soft Drink Bottles

Approved by the American National Standards Institute on November 23, 1977, as American National Standard ANSI/VPS PS 73–77

Abstract

This Voluntary Product Standard covers conventional returnable and nonreturnable glass bottles manufactured from soda-lime-silica glass with nominal capacity of up to and including 36 fluid ounces, intended for use in the packaging of soft drinks carbonated to a maximum of five volumes. This standard also covers conventional returnable and nonreturnable glass bottles manufactured from soda-lime-silica glass and nominal capacity in excess of 36 fluid ounces, but not in excess of 68 fluid ounces, intended for use in packaging soft drinks carbonated to a maximum of four volumes. The standard provides manufacturing requirements for temper number, thermal shock resistance, internal pressure strength, simulated impact resistance, abrasion resistance, detection of visual defects, wall thickness, dimensional tolerances for height and major body diameter, tolerances for capacity and weight, perpendicularity, bottom characteristics, and bottle identification. A statement to be used on manufacturing orders and invoices specifying the maximum carbonation volumes intended for use with the bottles is included.

These requirements apply only to glass containers currently being used and described as conventional containers; they do not apply to bottles which are plastic clad or encapsulated, chemically tempered, or the result of other novel or innovative engineering or design developments. Definitions of the trade terms used and methods for identifying products which conform to this standard are included. Included in an appendix is information showing the relation of apparent to real temper number.

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VOLUNTARY PRODUCT STANDARDS

Voluntary Product Standards are developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. The National Bureau of Standards administers the *Voluntary Product Standards* program as a supplement to the activities of the private sector standardizing organizations.

Establishment of a VOLUNTARY PRODUCT STANDARD

The role of the National Bureau of Standards in the establishment of a Voluntary Product Standard is to (1) act as an unbiased coordinator in the development of the standard, (2) provide editorial assistance in the preparation of the standard, (3) supply such assistance and review as is required to assure the technical soundness of the standard, (4) seek satisfactory adjustment of valid points of disagreement, (5) determine the compliance with the criteria of the Department's procedures, (6) provide secretarial functions for each committee appointed under the Department's procedures, and (7) publish the standard as a public document.

Producers, distributors, users, consumers, and other interested groups contribute to the establishment of a *Voluntary Product Standard* by (1) initiating and participating in the development of the standard, (2) providing technical or other related counsel as appropriate relating to the standard, (3) promoting the use of and support for the standard, and (4) assisting in keeping the standard current with respect to advancing technology and marketing practices.

Use of a VOLUNTARY PRODUCT STANDARD

The use of a *Voluntary Product Standard* is voluntary; the National Bureau of Standards has no regulatory power in the enforcement of the provisions of the standards. However, since the standards represent a consensus of all interested groups, their provisions are likely to become established as trade customs. In addition, when a standard is made a part of a legal document, such as a sales contract or code, compliance with the standard is enforceable.

The benefits derived from *Voluntary Product Standards* are in direct proportion to their general recognition and actual use. Producers and distributors whose products meet the requirements of a *Voluntary Product Standard* may refer to the standard in advertising and on labels to promote greater public understanding of or confidence in their products. Purchasers may order products conforming to the requirements of the standards.

For copies of the *Voluntary Product Standards* procedures or for more information concerning the development and use of these standards, you may write to: Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234.

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Carbonated Soft Drink Bottles

Effective September 15, 1977 (See section 6.)

(This Standard, initiated by the National Soft Drink Association and the Glass Packaging Institute, Inc., has been developed under the *Procedures for the Development of Voluntary Product Standards* of the U.S. Department of Commerce.)

1. PURPOSE

The purpose of this Voluntary Product Standard is to improve safety performance by establishing nationally recognized manufacturing requirements for conventional glass bottles designed as containers for carbonated soft drinks. This Standard is intended to provide producers, distributors, users and other interested groups with a basis for common understanding of the characteristics of these products.

2. SCOPE

This Voluntary Product Standard covers conventional returnable and nonreturnable glass bottles manufactured from soda-lime-silica glass with nominal capacity of up to and including 36 fluid ounces,[1] intended for use in the packaging of soft drinks carbonated to a maximum of five volumes. This Standard also covers conventional returnable and nonreturnable glass bottles manufactured from soda-lime-silica glass with nominal capacity in excess of 36 fluid ounces,[1] but not in excess of 68 fluid ounces, intended for use in packaging soft drinks carbonated to a maximum of four volumes. The Standard provides manufacturing requirements for temper number, thermal shock resistance, internal pressure strength, simulated impact resistance, abrasion resistance, detection of visual defects, wall thickness, dimensional tolerances for height and major body diameter, tolerances for capacity and weight, perpendicularity, bottom characteristics, and bottle identification. A statement to be used on manufacturing orders and invoices specifying the maximum carbonation volumes intended for use with the bottles is included.

These requirements apply only to glass containers currently being used and described as conventional containers; they do not apply to bottles which are plastic clad or encapsulated, chemically tempered, or the result of other novel or innovative engineering or design developments.[2] Definitions of the trade terms used and methods for identifying products which conform to this Standard are included. Included in an appendix is information showing the relation of apparent to real temper number.

Note: As an aid in correlating U.S. customary units to metric units, conversion factors for the units used in this Standard are given in appendix B.

3. DEFINITIONS

3.1. Returnable bottle—A returnable bottle is one which is manufactured to have the mechanical characteristics to provide for multiple service trips as a carbonated soft drink container.

3.2. Nonreturnable bottle—A nonreturnable bottle is one which is manufactured to have the mechanical characteristics to provide for one service trip as a carbonated soft drink container.

3.3. Carbonation volumes—Carbonated soft drinks are "carbonated" by dissolving carbon dioxide in water which is to become a part of the soft drink, or in the completely formulated soft drink itself. One volume of carbon dioxide gas will be absorbed by an equal volume of water at 60 °F and zero psi gage pressure (one atmosphere); correspondingly, at 60 °F four volumes of carbon dioxide gas will be absorbed by water at 45 psi gage pressure (four atmospheres) and five volumes will be absorbed at 60 psi gage pressure (five atmospheres).

3.4. Visual inspection—Visual inspection is the procedure which subjects bottles being produced to inspection by a person who detects and discards bottles which have observable defects.

[1] These bottle size ranges include the metric capacities of 1 liter (33.82 fluid ounces) and 2 liters (67.63 fluid ounces).

[2] The Standard Review Committee recognizes need for and recommends the future development of a voluntary standard for plastic clad or encapsulated bottles or other newly developed techniques.

3.4.1. **Automatic inspection**—Automatic inspection is the procedure which subjects every bottle being produced to scanning by mechanical, optical, or electronic means or stress loading, in order to discard bottles with defects which are detectable by these means.

3.5. **Visual defects**—Visual defects are the significant discontinuities or irregularities in the glass container which can be detected by visual inspection. Examples of such defects are cracks or stones.

3.6. **Perpendicularity**—The perpendicularity of a bottle is the total horizontal deviation of the top of the bottle from the perpendicular when rotated through 360° about the vertical axis (see fig. 1).

3.7. **Standard crown finish**—The standard crown finish is the upper portion of bottles designed to accept a fluted crown whose edges are crimped over the bottle opening (see fig. 1).

3.8. **Thread finish**—The thread finish is the upper portion of those bottles which are designed to accept a closure over external threads (see fig. 1).

3.9. **Bearing ring**—The bearing ring is the portion of the bottle base which contacts the supporting surface when the bottle is in an upright position. The contact area is on or adjacent to the outer circumference of the container (see fig. 1).

3.10. **Knurling**—Knurling is a pattern of small projections on the bottom surface of the bottle (see fig. 1, Bearing Ring).

3.11. **Cavity number**—The cavity number is the code that identifies the individual blow mold that forms the bottle.

3.12. **Lower specification value**—The lower specification value is the value which for the purpose of process control defines the lower limit below which a re-sampling procedure is to be instituted.

3.13. **Nominal capacity**—Nominal capacity is that fluid content as stated on the label of the product or embossed in the bottle.

3.14. **"Round" of bottles**—A "round" is one container from each producing cavity of the forming machine.

3.15. **Reject**—A reject is a bottle that is discarded from production and not shipped to users.

3.16. **Lower sidewall**—The lower sidewall is the lower section of the exterior bottle wall commencing with the tangent curve connecting into the base (bottom) of the bottle.

3.17. **Bottle sidewall**—The bottle sidewall is the vertical length as measured between the base tangent connecting point and the shoulder tangent connecting point of the bottle exterior (see fig. 1).

3.18. **Qualified inspection and testing agency**—A qualified inspection and testing agency is one that (a) has the facilities and trained technical personnel to perform reliable testing; (b) has developed standard procedures which are followed by its personnel in the evaluation of performance; (c) has no financial interest in, nor is financially dependent upon, any single company manufacturing the product or equipment being tested or any portion thereof; and (d) is not owned, operated, or controlled by any such company.

4. REQUIREMENTS

4.1. **General**—Products represented as conforming with this Voluntary Product Standard shall, at the time of manufacture, meet all of the applicable requirements specified in section 4. The inspection and test procedures contained in this Standard are for use to determine the conformance of products to the requirements of this Voluntary Product Standard. Each producer who represents his product as conforming to this Standard shall keep such essential records for at least one year as are necessary to document his claim that the requirements of the Standard have been met. Conformance with this Standard is not to be interpreted to mean that all bottles in a shipment will be free of defects.

4.2. **Temper number**—The bottles shall, after annealing, show no greater than Real Temper Number 4 when examined under polarized light and compared to standard disks in accordance with American Society for Testing and Materials (ASTM) C 148–71, *Standard Methods for Polariscopic Examination of Glass Containers*.[3] The relationship between real and apparent temper is shown in appendix A. At least one bottle shall be taken from each side and center of the annealing lehr at least every 2 hours during manufacture and tested for temper number.

[3] Later issues of this publication may be used providing the requirements are applicable and consistent with the issue designated. Copies of this publication are obtainable from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

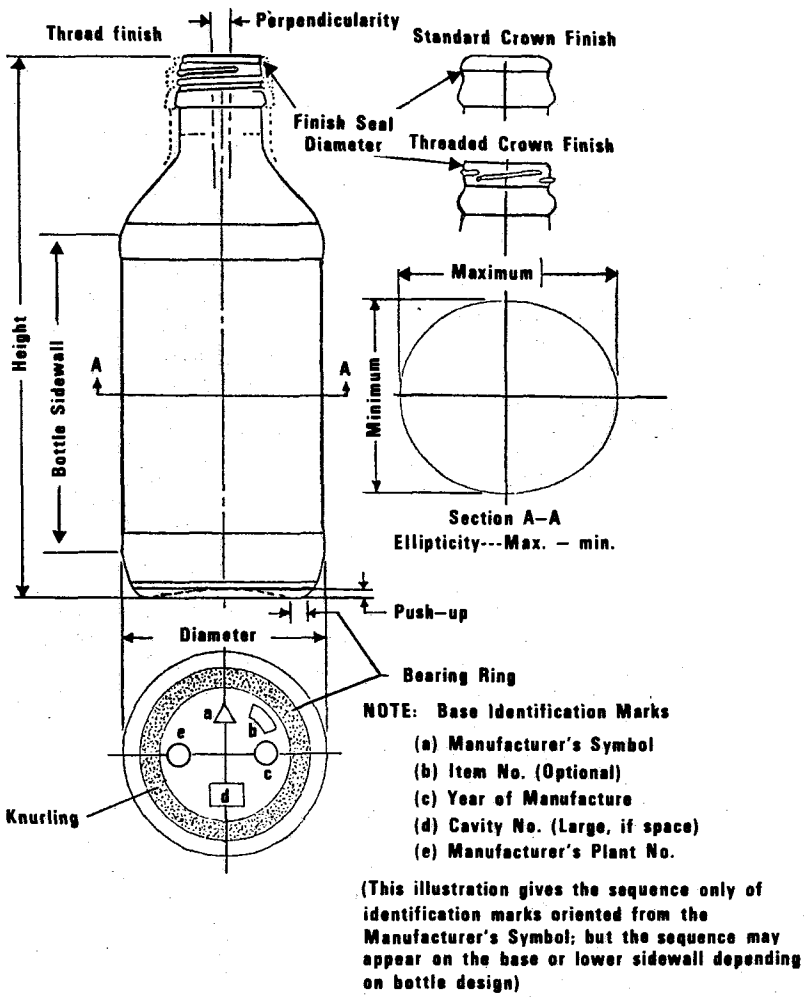

FIGURE 1. *Soft drink bottle.*

If a bottle from a certain row fails to meet the prescribed temper numbers, bottles from the adjacent row or rows shall be examined to identify and bracket all non-conforming bottles. The row or rows containing non-conforming bottles produced after the test failure shall be either rejected or re-annealed to conform to the ASTM standard until the condition causing the failure has been corrected. Correction will be indicated when two bottles, selected from each non-conforming row, pass the polariscopic examination.

Upon initial failure, all pallets loaded with bottles produced from that annealing lehr since the last satisfactory test shall be quarantined. The quarantined bottles from the questioned row or rows either may be rejected or shall be qualified for acceptance by testing in sets of two bottles selected in reverse order of production beginning with those last produced, until both bottles of the test pair indicate conformance. All non-conforming bottles so tested will be either re-annealed to conform or rejected. The quarantine shall then be removed.

4.3. Thermal shock resistance—The bottles shall withstand a hot to cold thermal shock of 75 °F differential, from a hot water bath of 145 ± 2 °F with a transfer time of 15 seconds (± 1 second) into a cold bath of 70 ± 2 °F in accordance with ASTM C 149–71, *Standard Method of Thermal Shock Test on Glass Containers.*[3] A round of bottles shall be taken from the lehr at least every 4 hours during manufacture and tested for thermal shock resistance.

If a bottle fails to pass the thermal shock test, four additional bottles selected from the next succeeding production of the represented cavity or cavities shall be tested. If a failure occurs among the four bottles selected for retest,

all bottles being produced from the represented cavity or cavities shall be rejected until the condition causing the failure has been corrected. Correction will be indicated when all four bottles of a retest lot pass the thermal shock test.

Upon initial retest failure, all pallets loaded with bottles produced from the represented cavity or cavities since the last satisfactory test shall be quarantined. The quarantined bottles from the represented cavity or cavities either may be rejected or shall be qualified for acceptance by testing in groups of four in reverse order of production beginning with those last produced following the test procedure described above until all four bottles of the test group indicate conformance. All bottles from any test group that did not indicate conformance when so tested shall be rejected. The quarantine shall then be removed.

4.4. Internal pressure strength—Returnable bottles shall withstand a minimum internal pressure of 225 psi and nonreturnable bottles shall withstand a minimum internal pressure of 200 psi. A round of bottles shall be taken at least every 2 hours from the lehr during manufacture for all sizes 36 fluid ounces and under, and at least hourly during manufacture on all sizes over 36 fluid ounces, and tested for internal pressure strength using one of the following methods:

(a) the 1-minute sustained pressure test in which pressure is sustained for 1 minute at each level, starting at 150 psi, at increments of 12.5 psi up to and including 200 psi and at 25 psi increments thereafter, in accordance with Method A of ASTM C 147–69, *Internal Pressure Test on Glass Containers*,[4]

(b) the increment pressure test, in accordance with Method A of ASTM C 147–69, *Internal Pressure Test on Glass Containers*,[4] and in which case the load duration is 3 seconds at each level starting at 150 psi and the actual applied pressure is 1.23 times the levels specified in the 1-minute sustained pressure test in 4.4(a). For example, for the levels of 225 and 200 psi, the actual applied pressures in the bottle are 278 and 247 psi, respectively.

(c) the continuously increasing test, sometimes called the ramp test, in accordance with Method B of ASTM C 147–69, *Internal Pressure Test on Glass Containers*,[5] and in which the 1-minute equivalent pressure is increased at a constant rate of 60 psi per second starting at zero psi and ending at the 1-minute equivalent pressure as specified in the requirement. The actual pressure applied in the bottle is given by the following equation:

$$P_R = 1.38\ P_{60} + 25.9,$$

in which P_R is the actual pressure applied in the bottle, and P_{60} is the 1-minute equivalent pressure as indicated by the ramp pressure test machine.

Note: Both the increment pressure tester and the ramp tester read out in equivalent to 1-minute pressure strength.

A producer may use automatic random offline pressure testing to conform with this section provided the procedures utilized will give results equivalent to those specified in (c) above, as certified by a qualified inspection and testing agency.

If a bottle fails to meet the internal pressure test, four additional bottles selected from the next succeeding production of the represented cavity or cavities shall be tested. If a failure occurs among the four bottles selected for retest, all bottles being produced from the represented cavity or cavities shall be rejected until the condition causing the failure has been corrected. Correction will be indicated when all four bottles of a retest lot pass the minimum internal pressure requirements.

Upon initial retest failure, all pallets loaded with bottles produced from the represented cavity or cavities since the last satisfactory test shall be quarantined. The quarantined bottles from the represented cavity or cavities either may be rejected or shall be qualified for acceptance by testing in groups of four in reverse order of production beginning with those last produced following the test procedure described above until all four bottles of the test group indicate conformance. All bottles from any test group that did not indicate conformance when so tested shall be rejected. The quarantine shall then be removed.

4.5. Simulated impact resistance—All bottles shall withstand a simulated impact by the application of at least a 50-pound force per

[4] See footnote 3, page 2.

[5] See footnote 3, page 2.

vertical inch of bottle sidewall loaded. The bottles shall be subjected to this impact resistance test around the full circumference in a suitable automatic device such as the squeeze-roll tester. (Bottles failing to meet this test are shattered, and are thus removed from production.)

4.6. Abrasion resistance (applicable only to nonreturnable bottles)—There shall be no seizing or audible grinding when surfaces of two wet bottles are rubbed together at an angle of approximately 45° under a 15-pound load at a rate not to exceed 3 inches per minute. A pair of bottles shall be taken from each side and the center of the annealing lehr at least every 2 hours during manufacture and tested for abrasion resistance. The bottles shall be immersed in water, two at a time, removed, and immediately tested.

If there is seizing or an audible grinding during this test, all non-conforming bottles produced after the test either may be rejected or shall be re-treated until the condition has been corrected. Correction will be indicated when both bottles of a retest pair pass the abrasion resistance test.

Upon initial failure, all pallets containing bottles produced from that annealing lehr since the last satisfactory test shall be quarantined. The quarantined bottles from the annealing lehr in question either may be rejected or shall be qualified for acceptance by testing, in sets of two, in reverse order of production beginning with those last produced, following the test procedures described above, until a pair indicate conformance. All non-conforming bottles so tested will be either re-treated to conform or rejected. The quarantine shall then be removed.

As an alternate, the manufacturer may use surface coating gaging devices which will give the same level of process control.

4.7. Inspection of visual defects—Bottles shall be free of the visual defects listed below. The producer of soft drink bottles shall use continuous visual inspection by trained inspectors or automatic inspection for detecting the defects listed below, except that automatic inspection devices shall be used to detect defects (1) through (3):

(1) **Check finish**—Shallow fractures confined to one surface of the glass container.

(2) **Choked neck**—Constriction of the inside of the neck and finish exceeding print specifications.

(3) **Split finish**—A crack extending from surface to surface extending from top of the finish downward.

(4) **Birdswings**—A string or strand of glass extending across the inside of the bottle.

(5) **Blisters**—Bubbles or gaseous inclusions 1/8 inch or larger in size.

(6) **Butterfly bruise**—A surface crack caused by a severe blow. The fracture is usually curved in shape extending into the glass from the outside surface.

(7) **Chipped finish**—An imperfection due to breakage of a small fragment out of an otherwise regular surface.

(8) **Cracks**—A break or a fracture extending into or completely through the glass from either surface.

(9) **Crizzle finish**—A frosty appearance on the sealing surface caused by a multitude of fine surface fractures which could prevent an adequate seal.

(10) **Down finish**—A sagging or irregular surface which could prevent an adequate seal.

(11) **Off-set seams finish**—Sealing surface or finish threads misaligned to such an extent that proper seal or removal torque cannot be maintained.

(12) **Overpress finish**—Glass fin projecting upward from the inside surface to the extent it may be broken or chipped in normal use.

(13) **Stones**—Unmelted batch or foreign matter 1/16 inch or larger in size embedded in bottle.

(14) **Stuck glass**—Extraneous glass fragments adhering to any surface.

4.8. Wall thickness—The wall thickness of the bottles shall meet the lower specification values for wall thickness shown in table 1. A round of bottles shall be taken from the lehr at least every hour during manufacture and tested for wall thickness in a manner which determines the thinnest section of the bottle.

If a bottle fails to meet the lower specification value, four additional bottles selected from the next succeeding production of the represented cavity or cavities shall be tested. If a

TABLE 1. *Wall thickness*

Returnable bottles

Major body diameter (O.D.)[a]	Lower specification values wall thickness
inches	*inch*
Up to and including 2-3/8	0.060
2-25/64 up to and including 2-25/32	.070
2-51/64 up to and including 3-9/64	.075
3-5/32 up to and including 3-3/4	.080
3-49/64 up to and including 4-1/4	.085
4-17/64 up to and including 5-1/2	.095

Nonreturnable bottles

Major body diameter (O.D.)[a]	Lower specification values wall thickness
inches	*inch*
Up to and including 2-11/16	0.045
2-45/64 up to and including 3.0	.055
3-1/64 up to and including 3-1/4	.060
3-17/64 up to and including 3-5/8	.065
3-41/64 up to and including 4-1/8	.070
4-9/64 up to and including 5.0	.075

[a] As specified in the Scope, all bottles with nominal capacity of up to and including 36 fluid ounces are intended for use in the packaging of soft drinks carbonated to a maximum of five volumes; all bottles with nominal capacity in excess of 36 fluid ounces, but not in excess of 68 fluid ounces, are intended for use in packaging soft drinks carbonated to a maximum of four volumes.

failure occurs among the four bottles selected for retest, all bottles being produced from the represented cavity or cavities shall be rejected until the condition causing the failure has been corrected. Correction will be indicated when all four bottles of a retest lot pass the wall thickness test.

Upon initial retest failure, all pallets loaded with bottles produced from the represented cavity or cavities since the last satisfactory test shall be quarantined. The quarantined bottles from the represented cavity or cavities either may be rejected or shall be qualified for acceptance by testing in groups of four in reverse order of production beginning with those last produced following the test procedure described above until all four bottles of the test group indicate conformance. All bottles from any test group that did not indicate conformance when so tested shall be rejected. The quarantine shall then be removed.

The wall thickness shall be determined by the use of a suitable device such as an extension leg micrometer. As an alternate, the manufacturer may use automatic wall thickness gaging devices which will give the same level of process control.

4.9. Dimensions and weight—

4.9.1. General—The bottles shall be of essentially round cross section design. Although the nominal height, major body diameter, capacity, and weight of the bottle may be agreed upon between producer and user, the tolerances for height, major body diameter, capacity, and weight of the bottle as manufactured shall meet the applicable tolerance requirements in 4.9.2 through 4.9.5. Each producer who represents his products as conforming to the dimensional and weight requirements of this Standard as covered in section 4.9 may utilize statistically based sampling plans which are appropriate for these manufacturing processes. Additional sampling and testing of the product, as may be agreed upon between purchaser and seller, is not precluded by this section. Requirements for perpendicularity and bottom characteristics are given in 4.9.6 and 4.9.7.

4.9.2. Height—The bottle height shall be within the following tolerance limits:

Nominal height range	Tolerance	
	Returnable	Nonreturnable
inches	*inch*	*inch*
Under 8	±3/64	±1/32
8 up to but not including 10	±1/16	±3/64
10 up to but not including 12	±5/64	±5/64
12 and over	±3/32	±3/32

The bottle height shall be measured from a plane of the bottom to a plane of the top opening using a scale calibrated to 1/64 inch.

4.9.3. Major body diameter—The major body outside diameter shall be within the following tolerance limits. The ellipticity or "out-of-roundness" shall not exceed that shown in the second column. (See ellipticity in fig. 1.)

Major body diameter range	Tolerance limit	Ellipticity not to exceed
inches	*inch*	*inch*
2 up to but not including 2-3/8	+3/64 −1/32	0.059
2-3/8 up to but not including 2-3/4	+1/16 −3/64	.082
2-3/4 up to but not including 3-5/8	±1/16	.094
3-5/8 up to but not including 4-1/8	+5/64 −1/16	.105
4-1/8 and over	±5/64	.117

The bottle shall be measured at its largest exterior barrel diameter using a caliper or equivalent device calibrated to 1/64 inch.

4.9.4. Capacity—The tolerance for the capacity of both returnable and nonreturnable bottles at the specified fill points shall be as follows:

Capacity [6]	Tolerance
fluid ounces	*fluid ounces*
6 up to and including 7	±1/8
8 up to and including 11	±5/32
12	±7/32
16 up to and including 17	±9/32
24 up to and including 28	±5/16
32 up to and including 36	±11/32
48 up to and including 68	±1/2

Capacity shall be measured with a device calibrated to 1/32 fluid ounce.

[6] The bottle size ranges include the metric capacities of 0.30 liter (10.15 fluid ounces), 0.50 liter (16.91 fluid ounces), 1.50 liters (50.73 fluid ounces), and 2.00 liters (67.63 fluid ounces).

4.9.5. Weight—The bottle weight shall be within the following tolerance limits:

Nominal weight range	Tolerance (returnable and nonreturnable)
avoirdupois ounces	*avoirdupois ounces*
Under 6	±1/4
6 up to but not including 9	±5/16
9 up to but not including 12	±3/8
12 up to but not including 17	+1/2, −3/8
17 up to but not including 22	+5/8, −7/16
22 up to but not including 28	+3/4, −1/2
28 and over	+ 1, −5/8

The weight shall be determined on a scale accurate to at least 1/64 ounce.

4.9.6. Perpendicularity—The perpendicularity of bottles with standard crown finish shall have a total indication or indicator reading of less than 0.250 inch when measured with the bottle resting on its base and rotated 360° against a centering device. Thread finish and threaded crown finish bottles shall have a total indication or indicator reading of less than 0.188 inch. The measurement shall be taken at the external horizontal surface of the finish seal diameter.

4.9.7. Bottom characteristics—

(a) **Push-up**—The center bottom push-up dimension for nonreturnable bottles shall be no less than 1/16 inch. Returnable bottles shall have sufficient push-up to insure resting on the bearing ring only.

(b) **Knurling**—Knurling shall be permissible on the bearing surface of both returnable and nonreturnable bottles.

4.10. Bottle identification marks—All bottles shall be legibly marked to show manufacturer's identification symbol, plant identification, cavity number, and year of manufacture (see fig. 1).

5. INTENDED USE

Intended use statement—Manufacturing orders and invoices shall contain a statement (or statements) which specifies the intended use of the bottles in each shipment. One or both of the following statements shall be used, as applicable:

(a) "Bottles with a capacity of up to and including 36 fluid ounces are intended for use in the packaging of soft drinks carbonated to a maximum of 5 volumes."

(b) "Bottles with a capacity in excess of 36 fluid ounces, but not in excess of 68 fluid ounces are intended for use in the packaging of soft drinks carbonated to a maximum of 4 volumes."

6. EFFECTIVE DATE AND IDENTIFICATION

The effective date of this Standard is September 15, 1977. As of the effective date, reference to PS 73–77 may be made in contracts, codes, advertising, invoices, product labels, and the like, but no product may be advertised or represented in any manner which would imply or tend to imply approval or endorsement of that product by the National Bureau of Standards, the Department of Commerce, or by the Federal Government.

The following statements are suggested for use in representing products as conforming to the requirements of this Standard:

(1) "This _____ conforms to all requirements established in Voluntary Product Standard PS 73–77, *Carbonated Soft Drink Bottles,* developed and published in accordance with the U.S. Department of Commerce *Procedures for the Development of Voluntary Product Standards.* Full responsibility for the conformance of this product to the standard is assumed by (name and address of producer or distributor)."

(2) "Conforms to PS 73–77, (name and address of producer or distributor)."

7. HISTORY

In January 1972, the National Bureau of Standards received requests from the Glass Packaging Institute and the National Soft Drink Association to develop a Voluntary Product Standard for bottles used by the carbonated soft drink industry.

The Standard was sent in April 1973 to numerous producers, distributors, consumers, and others in order that they could comment on the draft. The Standard was revised based on the comments received by the National Bureau of Standards in response to that mailing. In January 1974, a draft standard was sent to the Standard Review Committee for review. Consensus to circulate the standard for acceptance was not achieved. A meeting of the Committee was held in April 1974 to resolve differences. Based on agreements made at that meeting, a new draft was circulated to the Committee in the same month. Agreement was not reached. A 2-day Committee meeting was held in July 1974 and concluded with the Chairman agreeing to try to determine whether there was any possibility of agreement between members of the two proponent groups. The Chairman did not arrive at any agreements between the two groups. The two proponent groups held a meeting in September 1974 in which the Glass Packaging Institute agreed to develop a revised proposed draft and submit it to the National Bureau of Standards. After several drafts, it appeared differences between the two proponent groups had been resolved. A Committee meeting was held at the U.S. Department of Commerce facilities in June 1976 to consider the proposed draft. Minor modifications were agreed to and the draft supported unanimously. A follow-up letter ballot of the Committee indicated minor differences which were quickly resolved.

The Standard designated TS 215c, dated September 8, 1976, was circulated for acceptance in November 1976. Responses indicated consensus among producers, distributors, and consumers in accordance with the published procedures. The Standard was approved for publication by the National Bureau of Standards as Voluntary Product Standard PS 73–77, *Carbonated Soft Drink Bottles,* to be effective September 15, 1977.

Technical Standards Coordinator

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Washington, D.C. 20234

8. STANDING COMMITTEE

A Standing Committee has been appointed to assist in keeping this Voluntary Product Standard up to date. The names of the members of the committee are available from the Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234, which serves as the secretariat for the committee.

APPENDIX A

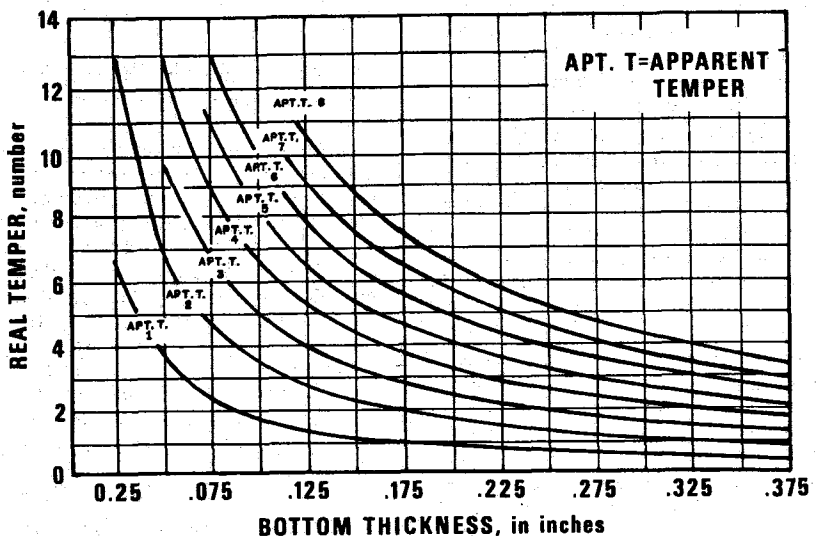
Relation of Apparent to Real Temper Number

The method used to determine the Real Temper Number corrected to 0.160 inch for each Apparent Temper Number and bottom thickness is as follows:

The amount of stress associated with annealing is a function of the retardation and the thickness of the light path. A convenient working formula to convert Apparent Temper to Real Temper is:

$$\text{Real Temper Number} = \frac{(\text{Apparent Temper Number}) \times (0.160)}{\text{thickness in inches}}$$

Figure 2 shows the relationship between Apparent and Real Temper Number as a function of bottom thickness.



APPENDIX B

Metric Equivalents

The conversion factors and units contained in this appendix are in accordance with the International System of Units (abbreviated SI for Système International d'Unités). The SI was defined and given official status by the 11th General Conference on Weights and Measures which met in Paris in October 1960. For assistance in converting U.S. customary units to SI units, see ASTM E 380, *ASTM Standard Metric Practice Guide*, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa., 19103. The conversion factors for the units found in this Standard are as follows:

1 inch = 25.4 millimeters
1 avoirdupois pound = 0.453 6 kilogram
1 pound per square inch = 6.894 8×10^3 pascals (N/m^2)
1 fluid ounce = 29.573 5 milliliters
1 avoirdupois ounce = 28.349 5 grams
$t_C = (t_F - 32)/1.8$
where t_C = temperature in degrees Celsius
t_F = temperature in degrees Fahrenheit
1 liter = 33.81 fluid ounces.

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